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Bridging the Gap: Can Mass Health Education Reduce Covid-19 Vaccine Hesitancy?

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ABSTRACT

Introduction: *Vaccine hesitancy is one of the top ten threats to global health. In Kenya, recent data suggests high levels of vaccine hesitancy. The study focused on assessing Covid-19 vaccination among individuals residing in Kericho County, Kenya while considering the potential role of mass education in vaccine hesitancy.*

Methods: *The study adopted the psychological antecedents of vaccination model to carry out a descriptive cross sectional survey of 1200 persons who attended outpatient services in sub-County hospitals. Simple random sampling was adopted and probability proportionate to size was ensured during sampling. Data was analyzed using proportion and chi-square tests.*

Results: *Participants who received health education had lower vaccine hesitancy. The study observed association between health education and socio-demographic and economic factors (P = < 0.001). A positive correlation between health education and confidence in vaccine safety, efficacy, trust in healthcare professionals, and trust in religious/cultural beliefs regarding vaccines was observed. The study further observed association between health education and reduced hesitancy across all complacency-related variables, convenience and constraint, collective responsibility and risk calculations.*

Conclusion: *While health education likely played a role in promoting vaccine acceptance, its effectiveness may be influenced by individual characteristics.*

Keywords: Hesitancy, Covid 19, Health education

1. INTRODUCTION

The emergence of the Covid 19 pandemic in late 2019 posed a significant threat to global health. The corona virus which was identified as the cause of Covid 19 disease rapidly spread, overwhelming healthcare systems and causing widespread illness and death. Globally, by the end of 2023 an estimated 6.9 million people had lost their lives, 175,000 and 5900 in Africa and Kenya respectively (Kenya Covid; WHO, 2024; WHO, 2023). Multiple strategies were put in place to lower both the attack and case fatality rates, and to curb the spread of the virus. Some of the strategies included lock down of movement across regions, keeping social distance, wearing face masks in public places and frequent handwashing. However, given the little success achieved with the prevention strategies, vaccine was viewed as the most potential alternative solution (Carneiro et al., 2021; Nagy & Alhatlani, 2021).

Scholars worked round the clock to develop Covid 19 vaccine, and to date it's the only vaccine developed within the shortest time, however to the detriment of its acceptance as skeptics questions the safety and efficacy of such vaccines (Savoia et al., 2021). With its advent, vaccination campaigns were therefore considered as the most effective strategy to fast-track control of the pandemic and achieve herd immunity. However, this was not the case. Most populations reported low utilization of the vaccines despite concerted efforts to roll out (Troiano & Nardi, 2021). A similar trend remains to date. Hence, vaccine hesitancy, the reluctance or refusal to vaccinate oneself or one's children despite the availability of vaccination services, remains a significant obstacle to achieving optimal Covid 19 vaccination coverage (MacDonald, 2015). Covid 19 vaccine acceptance rates in the United States were 56%, and 53% and 58% in Italy and France respectively (Padamsee et al., 2022; Sallam, 2021). However, the lowest acceptance rates were reported in developing countries, with Kuwait and Democratic Republic of Congo demonstrating hesitancy levels of 23% and 27% respectively, and 27% in Kenya (Anino et al., 2023; Sallam, 2021).

Studies have reported diverse factors that contributes to vaccine hesitancy. The 5Cs scale psychological antecedents' model of vaccination is increasingly considered as the most suitable model to measure and explain factors contributing to wide spread hesitancy (Betsch et al., 2018; Eitze et al., 2024). The factors described by the model are grouped into five categories of confidence, compliance, convenience or constraints, collective responsibility and risk calculations. Thus, to address vaccine hesitancy, health education has been used across populations with specific focus on factors under the five categories (Eitze et al., 2021; Hester et al., 2023). In Kenya, during the early stages of vaccine roll out, context specific health education messages were advanced to provide accurate, culturally-appropriate information about the benefits and safety of Covid 19 vaccine. For instance, in Kericho County, wide arrays of health education messages were used, including health education messages on the vaccine safety and

efficacy, messages deconstructing myths and misconceptions about vaccine and messages informing populations on vaccine access points and their importance in lowering the impact of Covid 19 disease (Anino et al., 2023). The county-based health education was offered through the community health units by the community health promoters. The Kericho county government anticipated health education to empower the residents and to inform their decisions about vaccination (MoH, 2022). They anticipated that mass education could address misinformation about safety and efficacy of the vaccines, which was widespread and build trust in healthcare providers and public health institutions. Therefore, the study sought to assess the role of mass health education in Covid 19 vaccine hesitancy among outpatients in Kericho County.

2. METHODS

2.1. Study design and sampling

The study was designed as an institution based cross sectional survey of outpatients in six sub county level referral hospitals in Kericho County. Simple random sampling was used to recruit 1200 participants to the study. However, owing to the variation in the patient's case management capacity, we used probability proportionate to size to enhance randomization of the recruits.

2.2. Data collection procedures and validity

Data was collected between October and December, 2023 using research administered close ended questionnaires. The questionnaire was formulated as a data collection tool based on the 5Cs antecedents' model for vaccination (Betsch et al., 2018). It was formulated in English and translated into local dialect and then retranslated into English to find misinterpretation and correction were made. Pretesting of the questionnaire was done at a non-sampled sub-County hospital by taking 5% of the sample and the findings was used to test content reliability using Cronbach's Alpha with a final test score of r = 0.8. Validity was also ensured by subjecting the questionnaire to a panel of 7 experts comprised of Public Health and Clinical officers from University of Kabianga. Data was collected by community health promotors on close monitoring and supervision by the research team led by the principal investigator. Twenty community health promotors with experience in data collection were trained for three days on approaches to data collection, probing and skipping pattern and on ensuring ethical consideration. In each sub-County four enumerators were sent to collect data. The collected data was reviewed and checked for completeness at the end of each day by the principal and co-investigators.

2.3. Data analysis

Data was analyzed using R version 4.3.1. The unit of analysis was patient. Bivariate analyses using chi – square test was carried out in order to assess the association between individual characteristics and the 5Cs psychological antecedents of vaccination with vaccine hesitancy. The data was stratified before carrying out any statistical test into two groups, received health education, and did not receive health education. Variables were considered to be statistically associated with dependent variable when $P < 0.05$, and the confidence interval was defined at 95%.

2.4. Ethical consideration

The study adhered to Helsinki ethical principle (Bošnjak, 2001). Ethical approval to carry out the study was granted by the University of Kabianga Ethical Scientific Review Committee and was assigned approval number IERC/2023/015. Both verbal and written consents were sought from the participants. The study also ensured confidentiality and privacy of the participants by carrying out the interview in a closed room, identifying the participants using a unique code though with traceable cell phone contacts, and storing the written consent forms in a lockable cabinet which can only be accessed by the research team.

3. RESULTS

Vaccine hesitancy across various individual characteristics was lower among the participants who had received health education compared to their counterparts who did not receive the education as shown in Table 1. Health education was found to be statistically associated with gender ($\chi^2 = 6.83$, $P = 0.009$), level of education ($\chi^2 = 69.10$, $< = 0.001$), occupation ($\chi^2 = 36.14$, $P = < 0.001$) and age of the participants ($\chi^2 = 12.75$, $P = < 0.001$). Among those who had received health education, males (220, 62.5%), persons with tertiary education (279, 58.1%), the employed (194, 62.2%) and persons aged 35 years and above (64, 53.3%) had the least hesitancy to Covid 19 vaccine. Level of education was also statistically associated with hesitancy among the participants in the group that had not received health education ($\chi^2 = 23.41$, $P = < 0.001$). Therefore, the reduction in hesitancy levels among those who had received health education could not directly be attributed to health education.

Table 1. Association between health education and vaccine hesitancy across various individual characteristics

Variable	Received mass health education, N = 836				Did not receive mass health education, N = 336			
	Hesitant 564 (%)	No hesitancy 272 (%)	χ^2	Cramer's V	Hesitant 308 (%)	No hesitancy 28 (%)	χ^2	Cramer's V
Gender			6.83	0.009			0.94	0.22
Female	344 (71.1)	140 (28.9)			204 (92.7)	16 (7.3)		
Male	220 (62.5)	132 (38.5)			104 (89.7)	12 (10.3)		
Education			69.10	< 0.001			23.41	< 0.001
None	36 (90.0)	4 (10.0)			60 (100)	-		
Primary	84 (100)	-			84 (95.5)	4 (4.5)		
Secondary	165 (71.1)	67 (28.9)			104 (92.9)	8 (7.1)		
Tertiary	279 (58.1)	201 (41.9)			60 (78.9)	16 (21.1)		
Occupation			36.14	< 0.001			16.76	0.05
House wife	68 (77.3)	20 (22.7)			36 (100)	-		
Student	205 (63.3)	119 (36.7)			40 (90.9)	4 (9.1)		
Employed	194 (62.2)	118 (37.8)			108 (84.4)	20 (15.6)		
Farmer	97 (86.6)	15 (13.3)			124 (96.9)	4 (3.1)		
Age			12.75	< 0.001			0.09	0.765
18 to 35	500 (69.8)	216 (30.2)			223 (89.9)	25 (10.1)		
> 35	64 (53.3)	56 (46.7)			85 (96.6)	3 (3.4)		

χ^2: Chi square, - No value

Table 2 shows the results on the relationship between health education on vaccine confidence knowledge areas and hesitancy. Health education was statistically associated with confidence in the vaccine safety (χ^2 = 34.90, P = < 0.001), confidence in the vaccine efficacy (χ^2 = 13.52, P = < 0.001), trust in advice from healthcare workers (χ^2 = 19.15, P = < 0.001), and trust in religious or cultural beliefs (χ^2 = 13.65, P = < 0.001). Hesitancy was significantly lower among those who had received health education compared to those who didn't for all the confidence related knowledge areas.

Those who had received health education, and had confidence in the safety of vaccines (392, 61.4%), confidence in the efficacy of vaccines (388, 63.8%), trusted government recommendations (476, 66.1%), trusted advice from healthcare workers (417, 62.8%), and trust in religious or cultural beliefs (280, 61.9%) were found to have the least hesitancy levels. However, the low hesitancy levels among those who had trusted the advice from healthcare workers couldn't be directly attributed to health education.

Table 2. Association between health education on vaccine confidence knowledge areas and hesitancy

	Hesitant 564 (%)	No hesitancy 272 (%)	χ^2	Cramer's V	Hesitant 308 (%)	No hesitancy 28 (%)	χ^2	Cramer's V
Safety			34.90	< 0.001			0.16	0.692
No	176 (86.3)	28 (13.7)			144 (92.3)	12 (7.7)		
Yes	388 (61.4)	244 (38.6)			164 (91.1)	16 (8.9)		
Efficacy			13.52	<0.001			0.43	0.510
No	176 (77.2)	52 (22.8)			152 (92.7)	12 (7.3)		
Yes	388 (63.8)	220 (80.9)			156 (90.7)	16 (9.3)		
Government recommendations			4.33	0.02				
No	88 (75.9)	28 (24.1)			92 (95.8)	4 (4.2)	3.06	0.08
Yes	476 (66.1)	244 (33.9)			216 (90.0)	24 (10.0)		
Advice from healthcare workers			19.15	< 0.001			9.55	0.002
No	147 (85.5)	25 (14.5)			80 (100)	-		
Yes	417 (62.8)	247 (37.2)			228 (89.1)	28 (10.9)		
Religious or cultural beliefs			13.65	< 0.001			0.433	0.510
No	284 (74.0)	100 (26.0)			153 (93.3)	11 (6.7)		
Yes	280 (61.9)	172 (38.1)			155 (90.1)	17 (9.9)		
Confidence in political beliefs			0.82	0.364			6.94	0.007
No	288 (69.0)	148 (31.0)			161 (91.5)	15 (8.5)		
Yes	276 (69.0)	124 (31.0)			147 (91.9)	13 (8.1)		

Lower vaccine hesitancy was observed among the participants who received health education as shown in Table 3. Other than the influence of family and friends, health education was found to influence vaccine hesitancy based on all the complacency related variables studied ($p < 0.001$). Among the participants that had received health education, those who were informed about vaccine had lower hesitancy (364, 59.9%), compared to their counterparts who were not informed (200, 87.7%).

Similarly, half of those who sought Covid 19 vaccination information on a daily basis had lower hesitancy, as well as those who were well aware about the transmission and prevention measures of Covid 19 disease (512, 65.3%). Those who perceived that getting vaccination was important also had low vaccine hesitancy (508, 65.5%) compared to their counterparts who didn't (56, 91.8%).

Table 3. Association between health education on complacency related factors and vaccine hesitancy

Variable	Received mass health education, N = 836				Did not receive mass health education, N = 336			
	Hesitant 564 (%)	No hesitancy 272 (%)	χ^2	Cramer's V	Hesitant 308 (%)	No hesitancy 28 (%)	χ^2	Cramer's V
Influence of opinion of family and friends			3.27	0.071			14.47	0.055
No	184 (71.9)	72 (28.1)			108 (100)	-		
Yes	380 (65.5)	200 (34.5)			200 (87.7)	28 (12.3)		
Informed about vaccine			58.60	< 0.001			7.67	0.061
No	200 (87.7)	28 (12.3)			172 (95.6)	8 (4.4)		
Yes	364 (59.9)	244 (40.1)			136 (87.2)	20 (12.8)		
Frequency of seeking information			27.58	< 0.001			29.28	0.111
Rarely	348 (75.7)	112 (24.3)			212 (94.6)	12 (5.4)		
Daily	32 (50.0)	32 (50.0)			4 (100)	-		
Weekly	61 (56.5)	47 (43.5)			12 (60.0)	8 (40.0)		
Monthly	123 (60.3)	81 (39.7)			80 (90.9)	8 (9.1)		
Understand transmission and prevention measures			26.74	< 0.001			10.84	0.324
No	52 (100)	-			88 (28.6)	-		
Yes	512 (65.3)	272 (34.7)			220 (88.7)	28 (11.3)		
Getting vaccinated is important			21.82	< 0.001			11.52	0.086
No	56 (91.8)	5 (8.2)			92 (100)	-		
Yes	508 (65.5)	267 (34.5)			216 (88.5)	28 (11.5)		

χ^2: Chi square, - No value

The relationship between health education on the variables presented in Table 4 and Covid 19 vaccine hesitancy was statistically different for all the variables, except for that on facing challenges in accessing vaccine (< 0.001). The hesitancy levels were far much lower for participants who had received health education when compared to those who had not. For instance, hesitancy among the individuals who had access to vaccine in the 'received health education' category was (204, 55.4%), compared to 52 (81.3%) in the 'did not receive health education' category.

A similar trend was observed for all the other variables; feeling a responsibility to protect others (441, 63.2%, vs 223, 90.0%), practicing recommended preventive measures (429, 64.1, vs 169, 87.6%), being concerned about the potential risk of vaccine (212, 53.5%, vs 68, 85.0%), and being concerned about contracting Covid 19 disease (228, 54.8%, vs 80, 87.0%).

Table 4. Association between health education on convenience and constraints, collective responsibility and risk calculations and vaccine hesitancy

Variable	Received mass health education, N = 836				Did not receive mass health education, N = 336			
	Hesitant 564 (%)	No hesitancy 272 (%)	χ^2	Cramer's V	Hesitant 308 (%)	No hesitancy 28 (%)	χ^2	Cramer's V
Access to vaccine			43.34	< 0.001			11.23	0.231
No	360 (76.9)	108 (23.1)			256 (94.1)	16 (57.1)		
Yes	204 (55.4)	164 (44.6)			52 (81.3)	12 (18.8)		
Faced challenges in accessing vaccine			0.82	0.364			0.91	0.340
No	275 (68.7)	125 (31.3)			192 (90.6)	20 (9.4)		
Yes	289 (66.3)	147 (33.7)			116 (93.5)	8 (6.5)		
Feel a responsibility to protect others			31.93	< 0.001			2.75	0.097
No	123 (89.1)	15 (10.9)			85 (95.7)	4 (4.3)		
Yes	441 (63.2)	257 (36.8)			223 (90.0)	24 (10.0)		
Practice recommended preventive measures			17.43	< 0.001			10.18	0.081
No	135 (80.8)	32 (19.2)			141 (97.2)	4 (2.8)		
Yes	429 (64.1)	240 (35.9)			169 (87.6)	24 (12.4)		
Concerned about potential risks of vaccine			66.50	< 0.001			6.11	0.073
No	352 (80.0)	88 (20.0)			240 (93.8)	16 (6.3)		
Yes	212 (53.5)	184 (46.5)			68 (85.0)	12 (15.0)		
Concerned about contracting Covid 19 disease			60.43	< 0.001			3.68	0.055
No	336 (80.0)	84 (20.0)			228 (93.4)	16 (6.6)		
Yes	228 (54.8)	188 (45.2)			80 (87.0)	12 (13.0)		

χ^2: Chi square, - No value

4. DISCUSSION

This study investigated the association between health education and vaccine hesitancy towards Covid 19 vaccine. While the findings demonstrated that participants who received health education had lower vaccine hesitancy, the data suggests this association may be confounded by underlying demographic characteristics. The observation is in tandem with previous studies which reported the potential of health education in promoting vaccine acceptance (Rani et al., 2022). A previous study found that a short educational intervention had a positive effect on parents' immunization knowledge and attitudes (Awadh et al., 2014). Similarly, another study showed that educational messaging combined with social media interventions increased Covid 19 vaccine acceptance (Anino & Sanga, 2024; Grosso et al., 2023). However, the study observed statistical association between health education and factors like gender, education level, occupation, and age which are a pointer that these characteristics may facilitate reception of health education messages. Furthermore, the independent association between level of education and vaccine hesitancy in both groups (with and without health education) strengthened the argument for confounding. Individuals with higher education may possess greater baseline knowledge and critical thinking skills, making them more receptive to scientific information on vaccines, regardless of specific educational interventions (Anino et al., 2023). These confirms the need for accounting for potential confounders when evaluating the impact of health education on vaccine hesitancy. Though in the current study stratified analyses was used, coupling it with propensity score matching could be important for future studies to isolate the true effect of the intervention (Webster-Clark et al., 2021).

The analysis revealed a positive association between health education and confidence in vaccine safety, efficacy, trust in healthcare professionals, and trust in religious and cultural beliefs regarding vaccines. These aligned with previous research which showed the effectiveness of educational interventions in fostering vaccine literacy and trust in scientific evidence (Chou & Budenz; Fu et al., 2014). Individuals who received health education and demonstrated confidence in vaccine safety and efficacy had the lowest hesitancy. This is likely because educational programs can address common concerns about vaccine side effects and effectiveness, thereby reducing apprehension and promoting informed decision-making. Interestingly, trust in healthcare workers' advice showed a significant association with lower hesitancy, even among those who hadn't received health education. This suggests that pre-existing trust in healthcare professionals may be a strong independent factor influencing vaccine acceptance. Other studies supported this argument, contending that healthcare providers play an important role in building trust and addressing vaccine hesitancy through open communication and tailored information (Leigh et al., 2022; Truong et al., 2022). However, the association between health education and trust in religious or cultural beliefs regarding vaccines requires further exploration. While the data showed that those with such trust had lower hesitancy, it's unclear if the education directly influenced this specific knowledge area.

The current study found a significant association between health education and reduced hesitancy across all complacency-related variables. This aligned with previous research on the effectiveness of educational interventions in promoting vaccine uptake by addressing knowledge gaps and fostering a sense of urgency regarding vaccination (Sangster & Barratt, 2021). Individuals who received health education and reported being informed about Covid 19 vaccines demonstrated the lowest hesitancy. This potentially indicated that educational programs could effectively combat complacency by raising awareness of the existence, benefits, and importance of vaccines. Similarly, those who actively sought out Covid 19 vaccination information daily exhibited lower hesitancy. This aligned with an earlier work which found that individuals who actively engaged with health information were more likely to hold positive attitudes towards vaccination (Chen et al., 2023). Furthermore, health education significantly reduced hesitancy among those who perceived vaccination as important for preventing Covid 19. This is because educational messaging can effectively address complacency by stressing on the individual and societal benefits of vaccination, promoting a sense of shared responsibility for public health.

Additionally, significant association between health education and reduced hesitancy across all variables on convenience and constraint, collective responsibility and risk calculations was observed, except for perceived challenges in accessing the vaccine. Though the finding did not wholly align with prior studies, it showed that educational interventions could be effective in promoting vaccine acceptance. Individuals who received health education and reported having access to vaccines exhibited significantly lower hesitancy which is contrary to earlier studies (Khairat et al., 2022; Lindholt et al., 2021). The findings reveals that educational programs might address logistical concerns and promote vaccine uptake by providing clear information on access points and eligibility. Similarly, those who reported feeling a responsibility to protect others through vaccination demonstrated lower hesitancy when they had received health education which is in agreement with the previous reports (Holzmann-Littig et al., 2021; Lindholt et al., 2021). Educational messaging may emphasize the concept of herd immunity and the societal benefits of vaccination, and thereby create a sense of shared responsibility for public health (Nan et al., 2022). Furthermore, health education significantly reduced hesitancy among those who practiced recommended preventive measures and those with concerns about vaccine safety (Grosso et al., 2023). This is because educational programs can breakdown anxieties surrounding vaccine side effects by providing accurate information on safety protocols and common post-vaccination experiences. Similarly, education can encourage continued adherence to preventive measures alongside vaccination, highlighting their complementary role in reducing disease transmission.

5. FUTURE IMPLICATION

Public health office should develop context specific educational messaging delivered through healthcare workers to address both individual knowledge gaps and social network dynamics to maximize vaccine uptake. Additionally, future research should explore how to tailor educational messaging to address specific anxieties and leverage the power of social responsibility to maximize vaccine uptake.

6. LIMITATION

A limitation of this study could be self-reported data bias. Participants may have over-reported their information-seeking behavior or the importance they placed on vaccination. Future research could employ objective measures of information access and utilize behavioral economics frameworks to assess the influence of perceived importance on vaccination decisions. Additionally, another limitation of this study was the potential for social desirability bias. Individuals who received health education might be more inclined to report positive attitudes towards vaccines, regardless of their actual beliefs. Future research could employ anonymous surveys or explore alternative methods to mitigate this bias.

7. CONCLUSION

In conclusion, while health education likely played a role in promoting vaccine acceptance, the findings showed that its effectiveness may be influenced by individual characteristics. Health education played a vital role in promoting vaccine confidence by addressing knowledge gaps and improving trust in scientific evidence and healthcare professionals. However, underlying factors like pre-existing trust and cultural beliefs also influenced vaccine hesitancy. In addition, health education reduced vaccine hesitancy by addressing complacency through increased awareness, information-seeking behaviors, and a sense of personal and community responsibility. Social influence was also a significant factor. Health education also showed a potential to reduce vaccine hesitancy by addressing logistical concerns, creating a sense of responsibility, mitigating anxieties about vaccine safety, and promoting continued adherence to preventive measures. While pre-existing anxieties about contracting Covid 19 may be a factor, educational interventions could target a range of concerns to promote vaccine acceptance.

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9. COMPETING INTEREST

The author declares no conflict of interest.

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